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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

REPORT ON THE LOMA PRIETA MINE (COPPER AND MOLYBDENUM)
COPPER BASIN, YAVAPAI COUNTY, ARIZONA

By Charles A. Anderson
June-July 1943

SUMMARY

The Loma Prieta mine is in Copper Basin, Yavapai County, Ariz., in sec. 21, T. 13 N., R. 3rd W. The development work, done in 1916-18, consists of a shaft 414 feet deep connected with 1,170 feet of drifts on four levels. Two or three cars of copper sulfide ore were shipped during this period. An Reconstruction Finance Corporation loan resulted in the recent dewatering of the mine, and the Geological Survey and Reconstruction Finance Corporation collaborated in the sampling of the mine. The ore consists of brecciated quartz diorite cemented by quartz veins carrying pyrite, chalcopyrite, and, locally, molybdenite. The form of the deposit is a vertical pipe of mineralized breccia having a cross-sectional area at the 400 level of 60,000 or more square feet with a cut-off grade at 0.45 percent Cu. The shaft reveals a 350-foot vertical extent of mineralized rock. Estimated reserves are 1,750,000 tons of indicated ore, with a grade of 0.85-0.9 percent Cu, and 0.10-0.15 percent MoS₂. Areas for additional exploration and prospecting are suggested.

INTRODUCTION

The Loma Prieta mine was recently dewatered following the granting of an Reconstruction Finance Corporation loan. The period from June 16 to July 23, 1943 was spent in an examination of the surface and underground workings, during which much of the time was devoted to sampling the mine in cooperation with Wm. B. Maitland, Supervising Engineer, RFC. S. C. Cressy assisted from June 16 to July 10. Following the completion of the sampling on July 15, the pump was pulled from the mine.

LOCATION

The Loma Prieta mine is in Copper Basin, Yavapai County, Ariz., in sec. 21, T. 13 N., R. 3 W. It is 11 miles west of Prescott and 7 miles east of Skull Valley, both of which are served by the Santa Fe Railroad. A fair gravel road with down grade to Skull Valley is available for trucking. The same road, but with rather steep grades, extends eastward to Prescott.

The elevations in Copper Basin are slightly above 5,000 feet. The basin has a gently rolling topography with several low hills rising above the surface. The Loma Prieta mine is located on a terrace to the east of Copper Basin Wash. There is little winter snow to impede mining operations.

The only water available at the Loma Prieta is from the mine itself, the supply being ample for diamond drilling. In the event a mill is constructed, it would be necessary to obtain water from outside the basin, either at Skull Valley or possibly from wells 4 miles to the southwest, where it is reported that thick water-bearing gravels are exposed.

The Commercial mine owned by Phelps Dodge Corporation joins the Loma Prieta to the northwest. The Copper Hill mine, now being explored for additional reserves in copper and molybdenum, is about a mile to the northwest of the Loma Prieta mine (see pl. 1).

OWNERSHIP

The Loma Prieta mine is owned by Mrs. Sophia Smoot of Prescott and is under lease and option to the Copper Basin Molybdenum Company, a partnership of Vic Hale, Nick Dugan, and Fred Gibbs, Sunnyvale, Prescott, Ariz. The Loma Prieta group includes 15 patented claims, of which only 4 were examined during this study. These are joined by patented claims of the Phelps Dodge Corporation (pl. 2).

DEVELOPMENT AND PAST PRODUCTION

The Copper Basin mining district was organized about 1890, and the Loma Prieta mine was started in 1916 by the Loma Prieta Mines Company, a stock company with most of the shareholders living in Prescott. All of the development work was done between 1916 and 1918. Two to three cars of sorted copper-sulfide ore were shipped during the development period.

The underground workings (pl. 3) are connected by a vertical shaft 414 feet deep that consists of a compartment and a half from the collar to 141 feet, and of a double compartment for the remainder. There are 40 feet of workings at the 46-foot level and a 10-foot stub at the 75-foot level. The 150 level (141 feet below the collar) has more than 850 feet of drifts. In all 1,170 feet of drifts were accessible for examination and sampling.

GEOLOGY

Exposures are poor or lacking in the area around the Loma Prieta mine owing to a blanket of terrace gravels up to 25 feet in thickness. Outcrops of the basement rocks are found only in the gulches, banks of the washes, and road cuts, except for scattered high outcrops that jut through the terrace gravels. Contacts between the various rocks can only be inferred, and plate 2 is essentially an outcrop map.

The prevailing rock is a fine- to medium-grained biotite-quartz diorite, deeply weathered in part and locally containing pyrite along the joints. The quartz diorite has been intruded by dikes of rhyolite and hornblende-biotite-quartz diorite porphyry. Outcrops of quartz veins were noted in two places.

MINERALIZATION

In the vicinity of the Loma Prieta mine, the quartz diorite has been brecciated and the fragments hydrothermally altered and cemented by quartz containing sulfide minerals which are altered to iron oxide at the surface. There are some textural variations of the quartz diorite, and in the breccia these are mixed together along with fragments of the quartz diorite porphyry. This heterogeneous assemblage and the generally elliptical outline in plan indicate that the brecciated quartz diorite is part of a breccia pipe. Because some of the fragments are 10 feet or more in dimension, and because the centers of these blocks are not appreciably altered, it is difficult in small surface exposures to distinguish massive quartz diorite from the brecciated core of the pipe. Some exposures of the quartz diorite have narrow intersecting quartz veins with pyrite and a little chalcopyrite. It is debatable whether they represent more barren portions of the breccia pipe or mineralized rock adjoining the pipe. In these areas of less conspicuous alteration and mineralization (shown on pl. 2 as weakly altered) there are small exposures of silicified breccia with strong goossens, indicative perhaps of a large pipe within which are scattered ore shoots of strongly brecciated and mineralized quartz diorite.

The copper molybdenum mineralization is best seen in the Loma Prieta mine, for the surrounding shallow shafts and short prospecting adits are rarely below the zone of oxidation. Neither molybdenite nor molybdate was observed at the surface.

The quartz cementing the breccia fragments is of two types. More commonly it is white and contains coarse feldspar crystals. This variety usually has vugs lined with carbonate (ankerite?). Less commonly the quartz is dense and flint-like, and its margins against the quartz diorite are indicative of some replacement of the latter. The sulfides are found in both varieties of quartz. Pyrite and chalcopyrite form coarse blebs and bunches, usually in the center of the cementing veins. The molybdenite is finely divided and forms narrow veinlets either at the margin of these cementing veins or crosscutting the quartz. In a few places the quartz veins are brecciated and cemented by later finely divided molybdenite.

The molybdenite is not uniformly associated with the chalcopyrite; some of the richer chalcopyrite-bearing veins may have only a trace of molybdenite, and the better molybdenite-bearing rock may have a low

content of copper. On the 150 level the better molybdenite showings are northeast and northwest of the shaft, while on the 400 level they are northeast and southeast of the shaft (pl. 4).

The few faults seen in the mineralized breccia have thin gouge zones. The faults are usually short and discontinuous, passing along the strike into closely spaced joints. Judging from the smears of sulfides in the gouge, the faults are post-mineral.

SAMPLING AND ASSAYING

The three sources of assay returns available for the estimation of grade of the copper have been plotted on Plate 4. Under the direction of A. B. Peach, Superintendent of the Loma Prieta mine, 5-foot blocks were sampled during the sinking of the shaft below the 150 level, and 10-foot blocks were sampled in part of the 400 level during the driving of the drifts. The method of sampling is unknown, but it is assumed that the blocks represent grab samples from the suck, as no channels are visible to relate to this sampling. In June and July, 1917, W. Tovote sampled the mine using hand moils for cutting narrow and shallow grooves, and many of these are still visible. During the present study, pneumatic chippers were used where possible to cut channels yielding 80 to 100 pounds per 10 feet of sample length. Each channel was kept as uniform as possible, but there was some variation in the depths of the various channels. The samples were broken and halved to 40 or 50 pounds and assayed for Cu and MoS_2 by the Union Assay Office, Salt Lake City, Utah. In a few places, hand moils had to be used for sampling, and these have been indicated on the assay plan (pl. 4); channels were cut comparable in size to those made by the chippers.

The southeast drift on the 400 level could not be sampled completely because of two caves that made work dangerous and because of difficulty in draining the water from behind suck dams formed by the caves. Beyond the caved places samples were taken every other 10 feet, and between the caves two samples were cut by hand moils in reasonably safe working places.

There is some variation in the sampling results, Peach's averages being higher than those of Tovote, and Tovote's averages higher than the recent samples. If Peach's samples were grab samples, his higher returns are easily explained by the difficulties of taking representative grab samples. Tovote's grooves are undoubtedly too shallow for representative sampling in this hard siliceous breccia and deeper channels yielding a greater volume of rock should give better results. Therefore, the earlier assay returns should probably be discarded and more confidence placed in the present lower results.

On the basis of these returns, the average for the 150 level is Cu 0.9 percent, MoS_2 0.15 percent. On the 400 level, using a cut-off

of 0.45 percent Cu, but omitting the samples from the southeast drift, the average is Cu 0.87 percent, MoS₂ 0.12 percent. By assuming that the samples taken from the mineralized block in the southeast drift are representative of the unsampled rock in the block (but discarding the two high returns LP #99 and LP #100 except for the 20 feet they represent) an average of 1 percent Cu and 0.16 percent MoS₂ is suggested. If this assumption is justified, the overall average of all the returns in the mineralized block on the 400 level is Cu 0.89 percent, MoS₂ 0.125 percent. The average of 88 samples from all levels and the shaft within the mineralized block is Cu 0.92 percent, MoS₂ 0.131 percent. It seems safe to state that the grade of the block as a whole is within the following limits: Cu 0.85 to 0.90 percent, MoS₂ 0.10 to 0.15 percent.

RESERVES

The suggested outline of the mineralized breccia is indicated on Plates 2 and 4 with an expected cut-off at its borders at about 0.45 percent Cu. All of the workings on the 150 level are in this block, so the area can be estimated only from the data on the 400 level, which gives a value of plus 60,000 square feet. This indicates plus 5,000 tons per foot of depth at the 400 level. There is no evidence from the surface exposures contrary to the possibility that this horizontal area of the mineralized block persists to the surface beneath the terrace gravels. Mineralized rock with fresh sulfides is exposed on the 46 level, and according to Peach (quoted in Tuvote's report) ore was encountered in the shaft at 60 feet and continued to the bottom of the shaft at 414 feet. Although the actual assay returns of Peach's samples must be discounted, they are indicative of copper mineralization of a grade in keeping with the returns from the 150 and 400 levels so that a vertical range of 350 feet is permissible in calculating reserves. Assuming 12 cubic feet to the ton of rock, there are about 5,000 tons per foot of depth, and a total of 1,750,000 tons of indicated ore having a grade of 0.85-0.90 percent Cu and 0.10-0.15 percent MoS₂.

RECOMMENDATIONS AND CONCLUSIONS

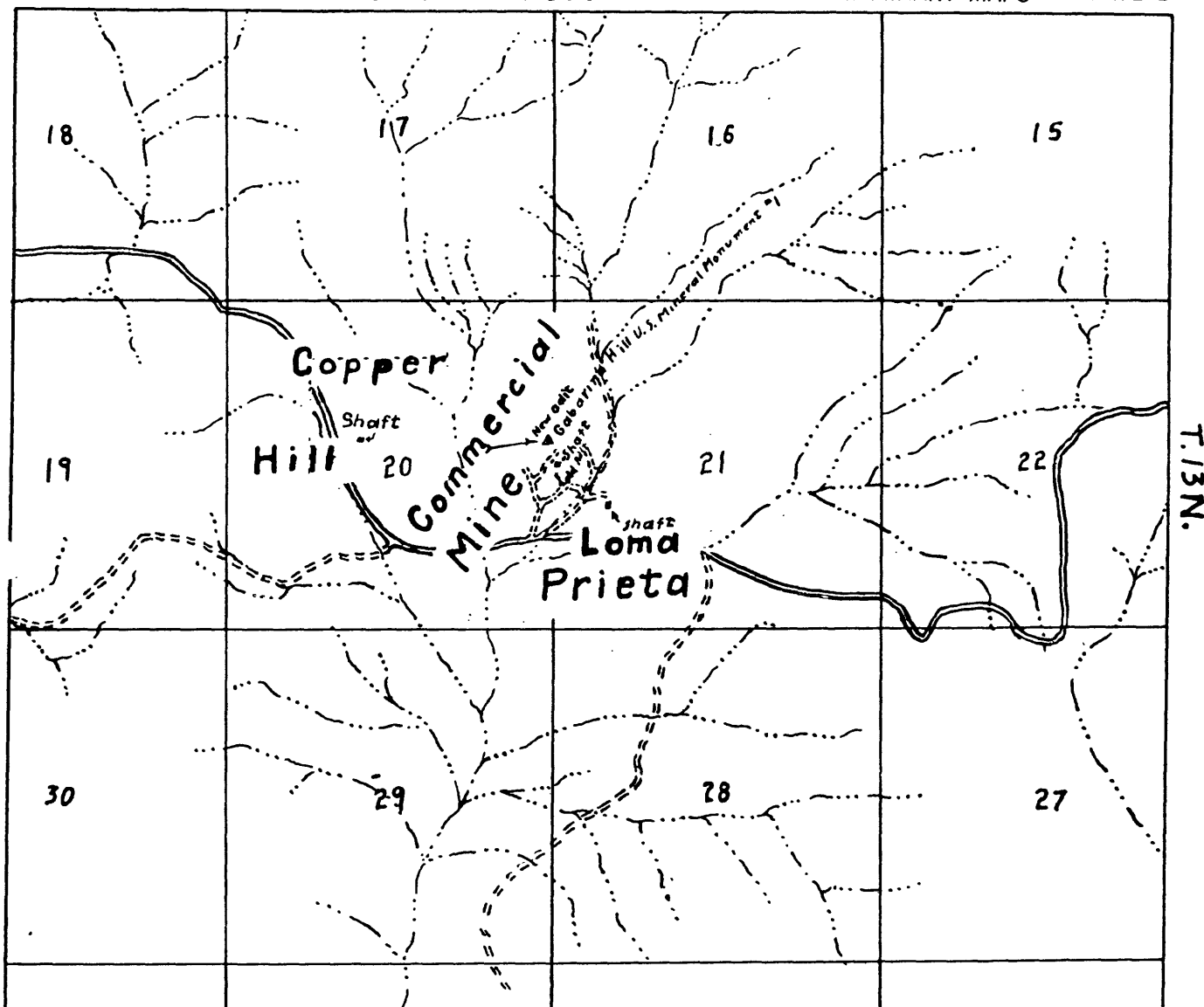
In spite of the large indicated reserves, the grade of the mineralized rock is a little low to encourage additional exploration, particularly since there is no evidence to support the possibility that the grade would be improved by such work. It is possible, however, that the estimated reserves could be increased by determining more accurately the outline of the known mineralized block, particularly in the northwesterly direction where the face is still in copper-bearing rock.

If it proves desirable to check the reserves, the suggested outline of the mineralized block should be explored from the 150 level,

and additional exploration in depth should add materially to the reserves. Additional exploration as indicated on Plate 5 might prove other ore shoots outside of and to the south and west of the main mineralized block. It is also possible that another mineralized block lies to the east of the Loma Prieta shaft, where there is a wide area of altered quartz diorite (pls. 2 and 5).

Charles A. Anderson
Geologist

July 29, 1943
Prescott, Arizona

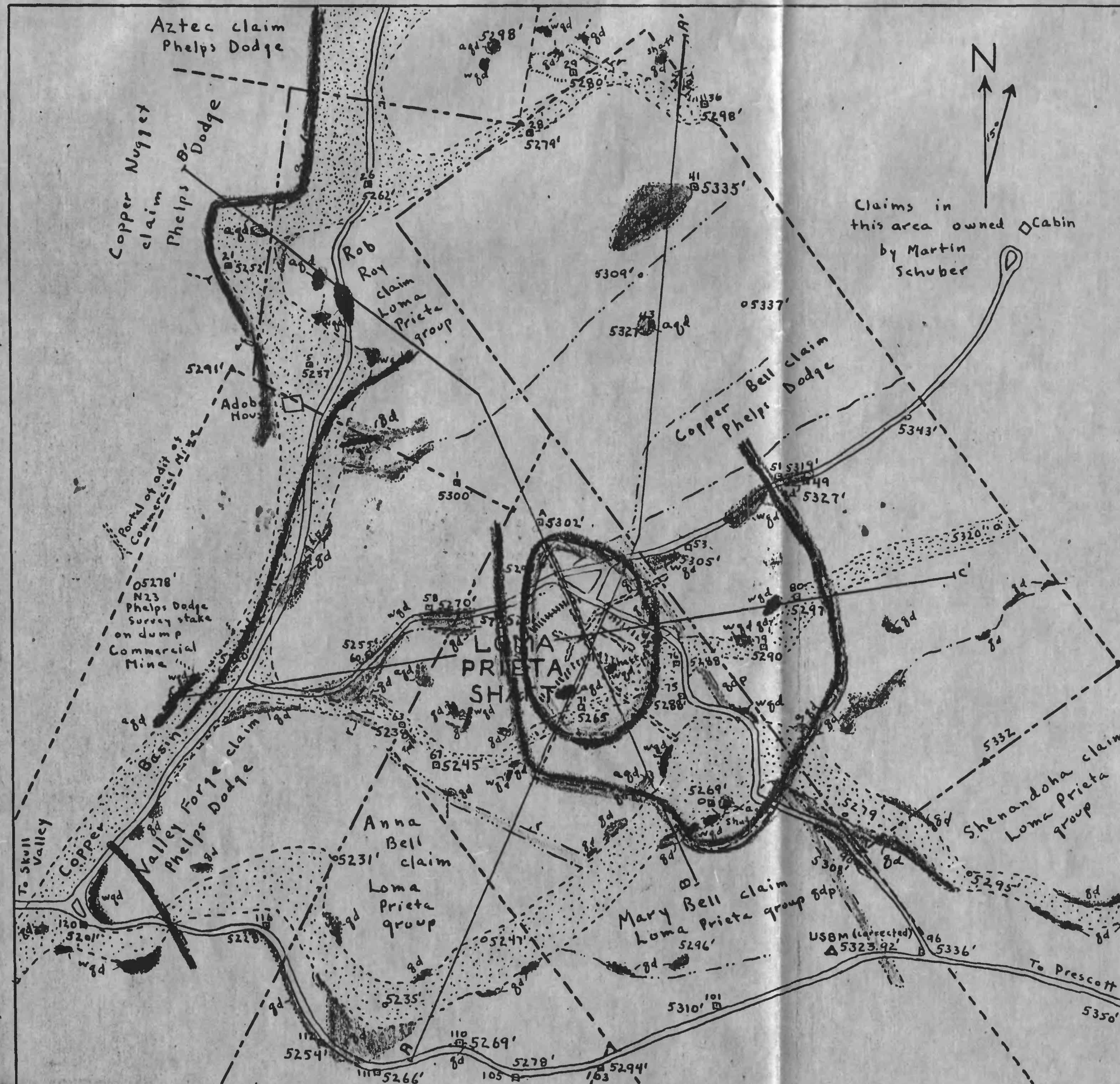


INDEX MAP OF COPPER BASIN

YAVAPAI COUNTY, ARIZONA

SCALE : 1 Inch = $\frac{1}{2}$ Mile

1943



LEGEND

- Largely terrace gravels
 - / Quartz vein
 - Rhyolite
 - Quartz diorite porphyry
 - Weakly hydrothermally altered and mineralized quartz diorite
 - Hydrothermally altered and mineralized brecciated quartz diorite
 - Quartz diorite
 - Inferred border of dikes
 - Inferred contact between fresh and altered quartz diorite
 - Outline of mineralized block
 - Claim boundary
 - Claim boundary between Loma Prieta and Phelps Dodge claims
 - Claim monument located
 - Instrument station with elevation. Smaller number station number.
 - Stadia station with elevation
 - Gulch
 - Wash
 - Edge of dump
- Area west of Copper Basin Wash and south of Skull Valley-Prescott road not mapped.

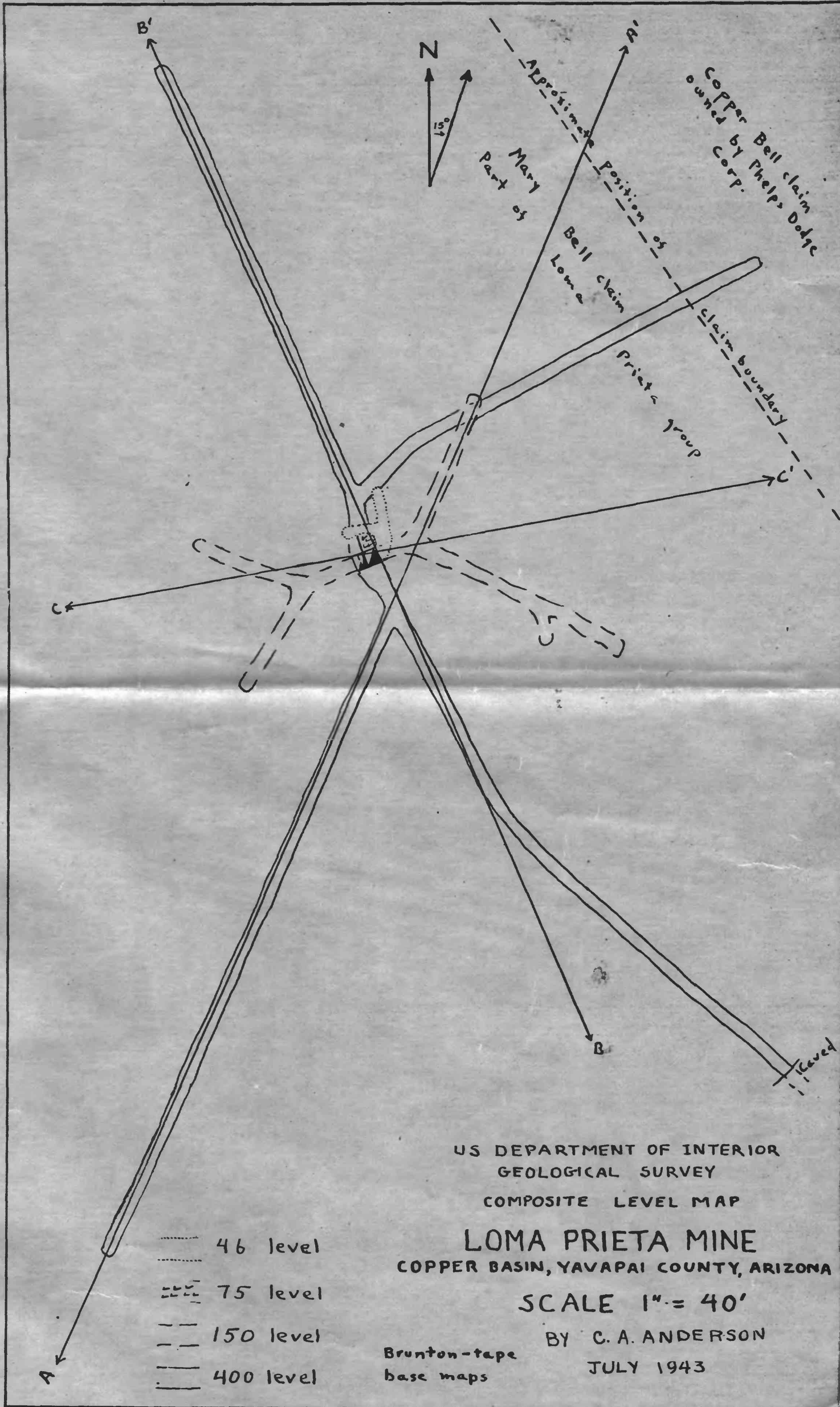
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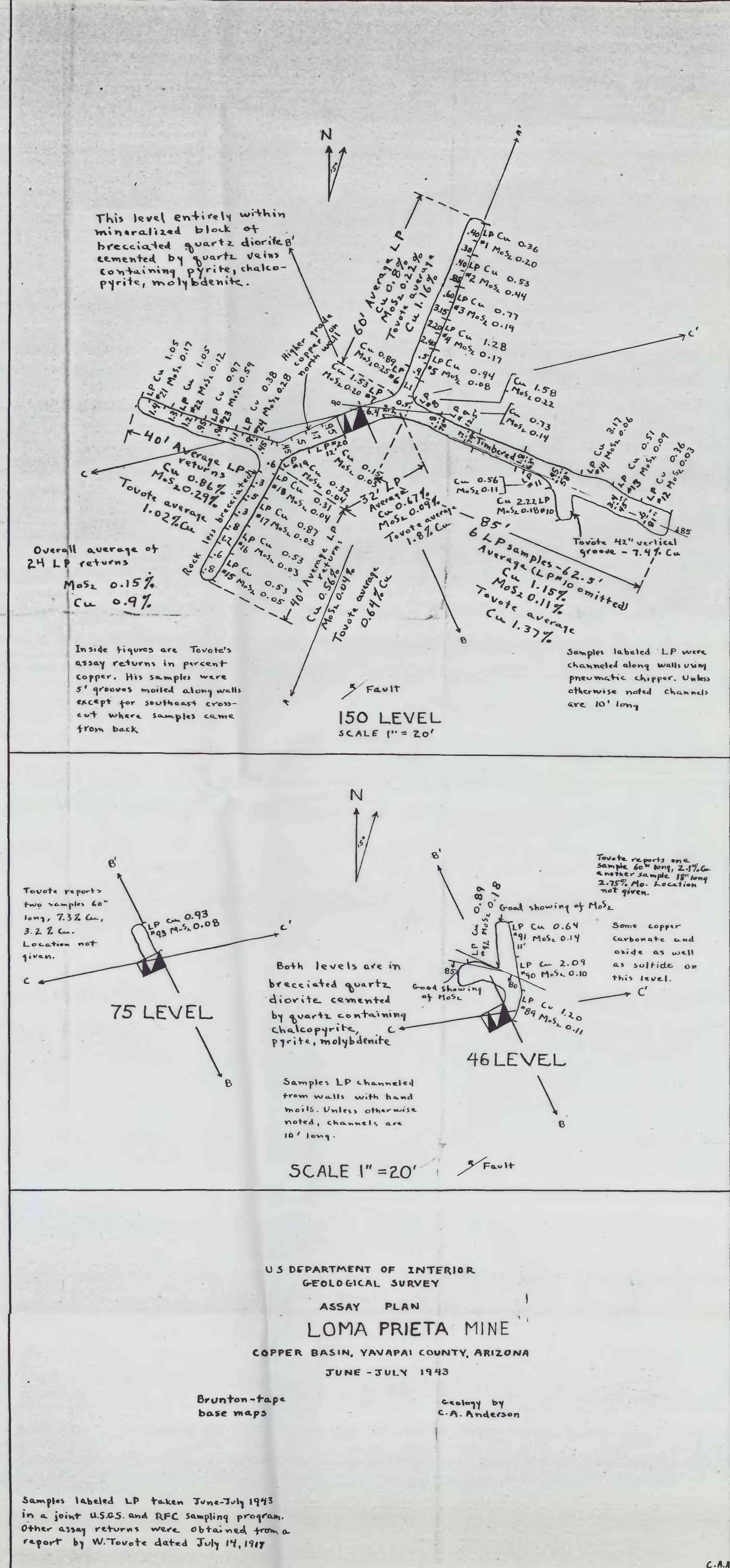
GEOLOGICAL MAP OF AREA AROUND
LOMA PRIETA MINE
COPPER BASIN, YAVAPAI COUNTY, ARIZ.

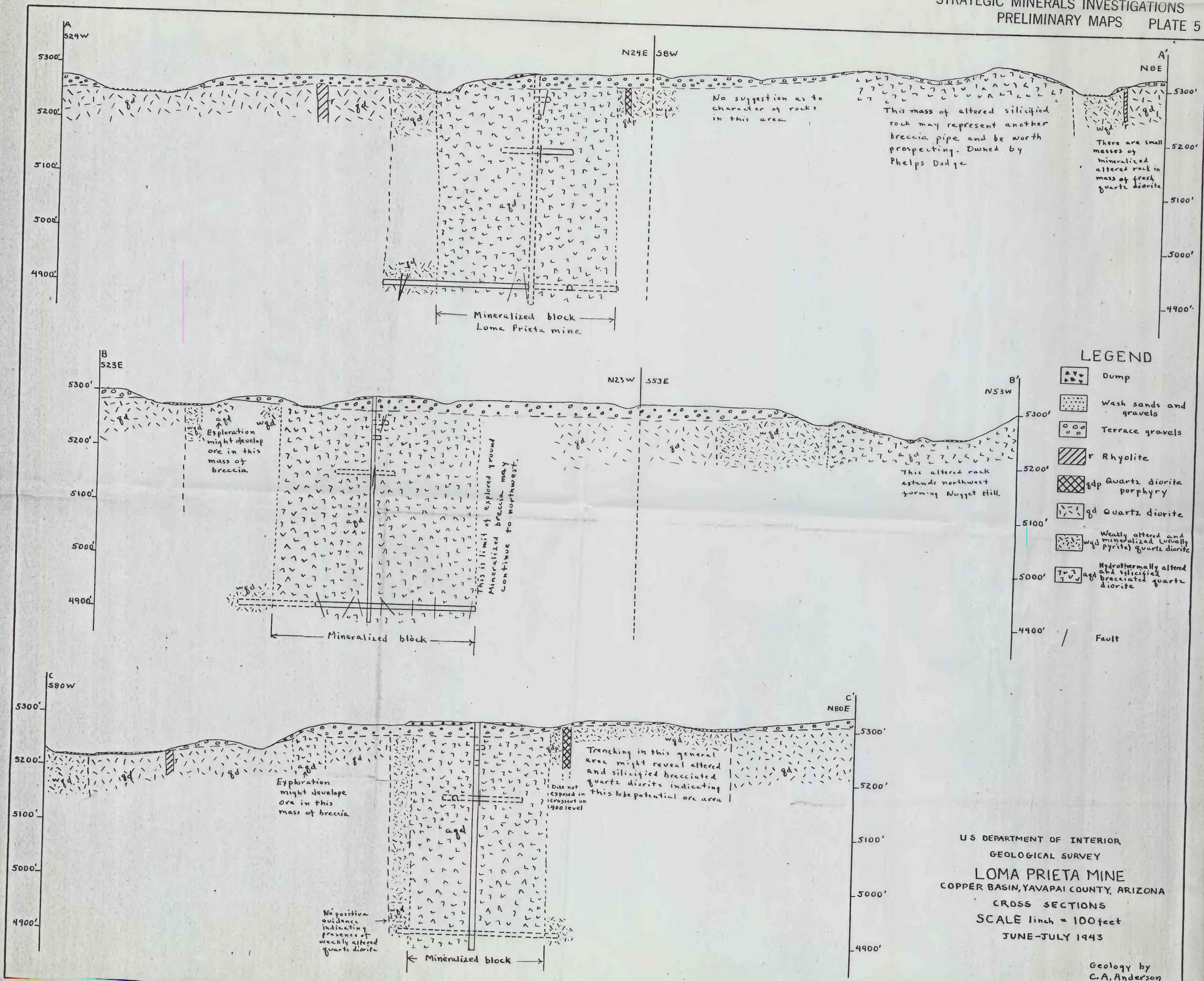
JUNE-JULY 1943

SCALE 1" = 200'

Plane table base map Geology by
by S.C. Creasey C.A. Anderson







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LOMA PRIETA MINE
COPPER BASIN, YAVAPAI COUNTY, ARIZONA
CROSS SECTIONS
SCALE 1 inch = 100 feet
JUNE-JULY 1943

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